ABSTRACT

Most microalgae are obligate photoautotrophs and their growth is strictly dependent on the generation of photosynthetically-derived energy. In this study it is shown that the microalga *Phaeodaclylurn tricornutum* can be engineered to import glucose and grow in the dark through the introduction of genes encoding glucose transporters. Both the human and *Chlorella kessleri* glucose transporters facilitated the uptake of glucose by *P. tricornutum*, allowing the cells to metabolize exogenous organic carbon and thrive, independent of light. This is the first successful trophic conversion of an obligate photoautotroph through metabolic engineering, and it demonstrates that methods of cell nourishment can be fundamentally altered with the introduction of a single gene. Since strains transformed with the glucose transport genes are able to grow non-photosynthetically, they can be exploited for the analysis of photosynthetic processes through mutant generation and characterization. Finally, this work also represents critical progress toward large-scale commercial exploitation of obligate phototrophic algae through the use of microbial fermentation technology, eliminating significant limitations resulting from light-dependent growth.